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Book review

A History of Plants in 50 Fossils

By Paul Kenrick
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Hardback, AU$34.99, ISBN 9781486313648

What is it about 50 that people want to summarise experiences, structures of landscapes, walks, etc into that number? There are '50 great walks and hikes for kids and families in South Australia', '50 great short stories' and then of course the infamous '50 Shades of Grey'! Perhaps it is a reasonable number to provide a useful range but not so many that the book becomes too big? Paul Kenrick provides a fascinating selection of 50 interesting and often beautiful plant fossils to summarise his view of how plant forms developed as the continents became clothed in green. He is a palaeobotanist at the Natural History Museum (London) with an interest in early land plants and the evolution of plants in general. He is an engaging writer with an enthusiasm for his subject and, being at the Natural History Museum, access to some very special fossils.

The book is compact with mostly about a page of explanation of each fossil facing the picture of the fossil and some extant species interspersed where appropriate. For instance, *Wollemia* from fern gullies in New South Wales manages to get a guernsey illustrating that it is still possible to find living plants appearing to be almost unchanged after 90 million years. Although the content is organised in approximately what might be considered a 'normal' sequence of fossil plants through geological time this is overlain on eight topics. The sequence begins with the origin of autotrophic plant forms (Hamersley banded iron), then on to the origin of plant organs, followed by tree form, biotic interactions, the classical sequence of gametophyte to sporophyte dominance, climate and continental movement, the origin of flowers and finally plants and humans. There is frequent interlinking of the focus fossil and what it can tell about things that happened later in prehistory. Understanding fossils requires a lot of imagination and in many cases a lot of detective work. Plants can produce many fossilised parts that give rise to different names for what was from the same organism and he points out that animals tend not to do this. It would be a very brave palaeobotanist who would reconstruct a whole plant from a single leaf but animal palaeontologists can sometimes do it from a single tooth. Perhaps they are more imaginative! Kenrick outlines a couple of sleuthing examples elucidating the affinities of *Archaeopteris* (*Callixylon*) that has characteristics of conifers and ferns, and of *Eospermatopteris* (*Wattieza*). *Eospermatopteris* was possibly the first tree and comes from the middle Devonian and illustrates an alternative way to construct a tree trunk. As it became extinct, the unusual stem structure was presumably not as functionally advantageous as the form developed, for example, in conifers that appeared later – perhaps it was not so functional in arid conditions?

While animal fossils may have more wow-factor – who could not be amazed at a dinosaur skeleton, plants are the basis of the biological Earth. Kenrick points out it is plants that have made the world habitable for the animals and have had more far reaching effects on climate than the animals. Plants have a great effect on the whole earth system. In fact, they continue to influence the climate even from their grave as we continue to burn them to power our lifestyles. Mass extinctions are dealt with, as is climate change, with the early lycopsids dominating tropical coal swamps in the Carboniferous, deciduous glossopterids on the edges of icesheets in the Permian, while in the Jurassic, conifer forests dominated the mid latitudes. The evidence for great climatic change over geological time covered in this book could provide ammunition for the recalcitrants in society who say climate change is a natural and normal part of the world and not related to human influence. However, Kenrick emphasises that climate change driven by human activity may have drastic consequences for vegetation, and in turn human populations, as a result of the rapidity of change.

It was likely a very difficult decision on what to include in the 50 fossils when the Natural History Museum undoubtedly has so many. However, Kenrick has selected many really interesting forms. One that particularly intrigued me was the *Azolla* impressions from the middle Eocene in the Arctic. Apparently, there was a 4 million square kilometre 'sea/lake' in the Arctic at that time and *Azolla* plants were produced prolifically every summer and incorporated into sediments during the winter. That such a small plant could form extensive deposits over a huge area indicates a truly unique set of circumstances that it would be hard to predict knowing the diminutive size of the plant.

The book is beautifully produced and the material is well organised. I have only minor niggly points in a couple of places where the information may be a bit misleading to some readers. On page 6 it is stated 'In this type of photosynthesis energy is generated from sunlight, carbon dioxide gas and water.' However, the energy is generated from the sunlight and stored using the conversion of carbon dioxide to carbohydrate. Some descriptions are a bit brief, especially when dealing with the alternation of generations in the early land plants. This is a complicated process. On page 24 it is said 'spores germinate, take root and develop into the sexual phase of the life-cycle'. For those who do not know much about the lower plants, it is not clear that the plant form is completely different in the sexual phase from the spore-producing stage and the gametophytes do not have roots. On page 28 seeds and spores are conflated – 'Seeds, technically called ovules before fertilization, are large spores…..'. However, spores produce the haploid generation and seeds produce diploid plants, they are not the same type of propagule.

The book has a very good index, a geological time scale and four diagrams of continental positions through time that enables one to locate the time and place of the fossils that are described. I can highly recommend this book as an instructive

glimpse into what is a very large field of endeavour. The information is written in a style that will be clear to scientists and non-specialists and provides more than just a summary of the history of plants, which is useful for students because this is now not often well covered in standard texts.

I wonder if, as we transition to a zero carbon economy, we will lose access to some of the material that has given us such a wonderful window into the development of plant life on this planet, not only from the coal, but from the associated sediments.

Philip Ladd
Environmental and Conservation Sciences
Murdoch University